STANDARD OPERATING PROCEDURE

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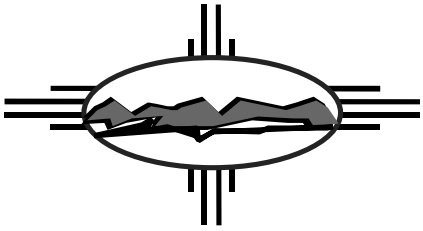
Sampling for Volatile Organics in Groundwater	**ER-SOP-6.03**	**1**	**03/08/99**



ER PROJECT

APPROVALS FOR USE

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Sampling for Volatile Organics in Groundwater

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NOTE: Environmental Restoration (ER) Project personnel may produce paper copies of this procedure printed from the controlled document electronic file. However, it is their responsibility to ensure that they are trained on and utilizing the current version of this procedure. The procedure author may be contacted if text is unclear.

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the collection of groundwater samples from monitoring wells for analysis of volatile organic compounds (VOCs), and the selection of equipment and materials to be used in this process.

2.0 TRAINING

The **Field Team Leader** (FTL) is responsible for ensuring that field team members who collect VOC samples for the ER Project are trained in the operation and calibration of the field analytical equipment. In addition all field team members who use this procedure shall be familiar with the objectives of VOC sampling and must document that they have read and understand this procedure in accordance with QP-2.2.

3.0 DEFINITIONS

3.1 *Site-Specific Health and Safety Plan (SSHASP)*—A health and safety plan that is specific to a site or ER-related field activity that has been approved by an ER health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

4.0 BACKGROUND AND PRECAUTIONS

Note: This SOP is to be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on and use of all PPE.

4.1 Sample retrieval systems potentially suitable for the valid collection of volatile organic samples are reciprocating piston-type submersible pumps, gear-driven submersible pumps, syringe samplers, and bailers (Barcelona et al., 1984; Bennett, 1988; Nielsen et al., 1985; EPA, 1986; EPA Region 4, 1991).

Field conditions and other considerations will limit the choice of system. The objective is to provide a valid sample for analysis, one that has been subjected to the least amount of turbulence and subsequent possible aeration.

4.2 Construction materials for pumps, bailers, and tubing are limited to stainless steel, Teflon, and glass. The tendency of organics to leach into and out of many materials makes the selection of sampling materials critical for these trace analyses. Plastics such as Tygon, for example, should be avoided.

4.3 There are numerous ways of introducing foreign contaminants into a sample, and these must be avoided by following strict sampling procedures and using only trained personnel.

4.4 Treatment of the sample with sodium thiosulfate or other appropriate preservative is required only when there is residual chlorine in the water. Residual chlorine could cause free radical chlorination and change the identity of the original contaminants.

4.5 If floating organics are of concern (as determined by field measurement for floating organics), a representative sample cannot be confidently obtained.

4.6 The sensitivity of the analysis and the fragility of the samples require that a minimum of two containers should be employed for each VOC sample.

4.7 Holding time for the analysis of volatiles is 7 days; vials for volatile organic analysis (VOA) may be kept for up to 14 days when the samples are preserved with acid. The samples will be shipped to the Sample Management Office (SMO) daily or following each completed sampling effort. Sample shippers (coolers) will be sealed with custody seals. They must also be adequately packed and cooled to ensure that they arrive intact and within the acceptable temperature range. Refer to ER-SOP-1.03 for further instructions.

4.8 Due to the short holding times, avoid collecting VOC samples before holidays or weekends. Samples submitted to the SMO after 2:30 p.m. will not be shipped until the following day.

5.0 EQUIPMENT

A checklist of suggested equipment and supplies required to implement this procedure is provided in Attachment A. Sampling mechanisms capable of obtaining samples for VOC analyses are described below.

5.1 *Reciprocating Piston-Type Submersible Pumps* — These systems are portable, self-contained, and capable of delivery flow rates of 30 gal./hr at lifts up to 500 ft. The pump fits into 2-in. wells, which is the most common monitoring-well diameter. The flow rate of the pump is varied by increasing

or decreasing the driving pressure supplied to the pump from a compressed-air container. The gasoline that powers the pump does not contact the sample being purged.

5.2 *Gear-Driven Submersible Pumps* — These pumps provide comparable samples and are often easier to handle and cleaner than other pumps. More care, however, must be exercised when sampling with them because the flow rate is not controllable, and a greater potential for splashing and aeration of the sample exists.

5.3 *Syringe Samplers* — Only a limited number of commercial, syringe-type samplers are available (two vendors are IEA and TIMCO). These devices are limited in sample volume and are specific for sampling volatiles. They operate with an evacuated chamber that is lowered down the well and allowed to fill because of the pressure of the water. The entire mechanism is brought to the surface with the sample. The sample can then be transferred to a sample vial, or, if preservation with chemical additives is not required, the entire unit may be sent as the sample container.

5.4 *Bailers* — The Teflon closed-top, bottom-charging type is the most appropriate bailer to collect water samples for volatile analysis. The bottom-emptying device with a tap is also desirable. Several vendors provide acceptable designs. Generally, bailers can collect a representative sample, provided that the sampling personnel use extra care in the collection process.

6.0 PROCEDURE

Note: Deviations from SOPs are made in accordance with QP-4.2.

6.1 Preoperation Activities

6.1.1 Assemble the equipment and supplies listed in Attachment A. Ensure that all equipment operates properly. If any equipment requires calibration, be sure to record this information on the Daily Activity Log form (Attachment E in ER-SOP-1.04), the Water Quality Sampling Record (Attachment B in ER-SOP-6.01), and the field notebook as specified in ER-SOP-1.04.

6.1.2 Coordinate the sampling effort with the SMO. The SMO will give guidance in regard to sample containers, preservation, and shipment to the SMO.

6.1.3 Locate monitoring wells to be sampled and establish an appropriate decontamination area. Select the staging area and areas for managing purged water and expendable sampling materials.

6.1.4 In accordance with ER-SOP-1.08, decontaminate all sampling equipment before taking the first sample and between sampling intervals.

6.2 Sampling

6.2.1 Purge wells before sampling, as specified in ER-SOP-6.01. Ensure that the wells were not pumped dry and that flow is at a rate too low to cause turbulence in the formation.

6.2.2 Perform other sampling tasks as specified in ER-SOP-6.02 before collecting volatile samples.

6.2.3 Determine if there is residual chlorine in the water to be sampled. If there is residual chlorine, treat the sample vials before sample collection with sodium thiosulfate or other appropriate material according to the site-specific Sampling and Analysis Plan (SAP).

6.2.4 Determine contamination levels of wells. Monitoring wells should be sampled by moving from the least to the most contaminated areas to reduce the possibility for cross-contamination.

6.2.5 Collect VOC samples using the most appropriate sampling mechanism following the site-specific SAP.

6.2.6 If a pump is used for sampling, follow the manufacturer's operating instructions for that specific pump. If a syringe is used, follow these steps:

6.2.6.1 If necessary, evacuate the syringe. Lower the sampling device to just below the well screen.

6.2.6.2 Remove the constriction from the device and allow the syringe to fill with sample by applying slight suction.

6.2.6.3 Bring unit to the surface. If necessary, transfer the sample to vials.

6.2.7 If a bailer is used, follow these guidelines:

6.2.7.1 Spread a new plastic sheet on the ground around the wellhead, inside a secure, delineated zone, to establish a clean working area.

6.2.7.2 Decontaminate all sampling equipment per ER-SOP-1.08.

6.2.7.3 Cool the bailer and sample containers before use to approximately the groundwater temperature. Avoid exposing them to direct sunlight.

6.2.7.4 Lower the Teflon closed-top, bottom-charging bailer into the water column slowly, and note its depth below ground level. Stop when the bailer reaches the well's screened interval.

6.2.7.5 Slowly recover the bailer; collect the cable either onto a reel or into a cleaned stainless steel bucket.

6.2.7.6 Use the bailer's bottom discharge tube (Teflon) to fill the 40-ml vials by slow drainage from the tube.

6.2.7.7 Repeat steps in Sections 6.2.7.3 through 6.2.7.6 as often as necessary to acquire sufficient sample quantities.

6.2.8 The vials (40-ml) should be completely filled to prevent volatilization, and extreme caution should be exercised when filling a vial to avoid any turbulence that could also produce volatilization. The sample should be carefully poured down the side of the vial to minimize turbulence. As a rule, it is best to gently pour the last few drops into the vial so that surface tension holds the water in a "convex meniscus." The cap is then applied and some overflow is lost, but air space in the vial is eliminated. After capping, turn the vial over and tap it to check for bubbles. If any bubbles are present, repeat the procedure once. If a second try is required, use a new sample container.

6.2.9 When water samples for purgeable organic compounds are collected, duplicate samples should always be collected from each location. Water samples to be analyzed for purgeable organic compounds should be stored in 40-ml septum vials with a screw cap and a Teflon silicone disk in the cap to prevent contamination of the sample by the cap. The disks should be placed in the caps (with Teflon side in contact with the sample) by the sample container's vendor before the beginning of the sampling program.

6.2.10 After each use, the sampling equipment must be decontaminated in accordance with ER-SOP-1.08.

6.2.11 A sampling blank should be acquired periodically to test the decontamination procedure's efficiency.

6.3 Documentation

6.3.1 Follow ER-SOP-1.04 for documenting all pertinent information (such as weather conditions, deviations, and turbidity of sample) in the field notebooks or Daily Activity Log forms. All labels will be completed and affixed as indicated in ER-SOP 1.04.

6.3.2 Document the calibration of field instruments as specified in ER-SOP-6.02.

6.3.3 Document well purging as specified in ER-SOP-6.01.

6.4 Postoperation Activities

6.4.1 Decontaminate sampling equipment as instructed in ER-SOP-1.08.

6.4.2 Make sure all wells are properly labeled and that the location ID is readily visible on the protective casing.

6.4.3 Prepare samples and transport them to the SMO according to ER-SOP-1.02, ER-SOP-1.03, and ER-SOP-1.04.

6.4.4 The FTL will contact the SMO to ensure that samples arrive safely and the instructions for sample analyses are clearly understood. Record this information in the field notebook or on the Daily Activity Log form (Attachment E in ER-SOP-1.04).

7.0 REFERENCES

The following documents have been cited within this procedure.

QP-2.2, Personnel Orientation and Training

QP-4.2, Standard Operating Procedure Development

QP-4.3, Records Management

ER-SOP-1.02, Sample Containers and Preservation

ER-SOP-1.03, Handling, Packaging, and Shipping of Samples

ER-SOP-1.04, Sample Control and Field Documentation

ER-SOP-1.08, Field Decontamination of Drilling and Sampling Equipment

ER-SOP-6.01, Purging of Well for Representative Sampling of Groundwater

ER-SOP-6.02, Field Analytical Measurements of Groundwater Samples

Barcelona, M. J., J. A. Helfrich, E. E. Garske, and J. P. Gibb, 1984. “A Laboratory Evaluation of Groundwater Sampling Mechanisms,” in *Groundwater Monitoring Review*, Spring 1984, pp. 32–41.

Bennett, Robert Co., “Operation Manual for the Bennett Sampling Pump,” (Amarillo, TX, 1988).

EPA, “RCRA Ground-Water Monitoring Technical Enforcement Guidance Document,” (OSWER, Washington, D.C., 1986).

EPA Region 4, “Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual,” (Environmental Services Division, Athens, GA, 1991).

Nielsen, D. M. and G. L. Yeates, “A Comparison of Sampling Mechanisms Available for Small-Diameter Groundwater Monitoring Wells,” *Groundwater Monitoring Review*, Spring 1985, pp. 83–99.

8.0 RECORDS

The **FTL** is responsible for submitting the following records (processed in accordance with QP-4.3) to the Records Processing Facility.

8.1 Daily Activity Log forms (Attachment E in ER-SOP-1.04) or field notebooks, including any deviation(s) or other pertinent information

8.2 Sample Collection Logs (Attachment B in ER-SOP-1.04), including any deviation or other pertinent information.

8.3 Water Quality Sampling Records (Attachment B in ER-SOP-6.01)

8.4 Water Quality Stabilization Records (Attachment B in ER-SOP-6.02)

9.0 ATTACHMENTS

The document user may employ documentation formats different from those attached to/named in this procedure—as long as the substituted formats in use provide, as a minimum, the information required in the official forms developed by the procedure.

Attachment A: Equipment and Supplies Checklist for Sampling Volatile Organics (1 page).

Equipment and Supplies Checklist for Sampling Volatile Organics

____ Teflon stainless steel bladder pump and its manufacturer's operating manual

____ Teflon stainless steel gear-driven submersible pump and its manufacturer's operating manual

____ Syringe sampler (stainless steel, Teflon, or glass) and its manufacturer's operating manual

____ Teflon bailer (closed-top, bottom-charging) and its manufacturer's operating manual

____ Teflon or other chemically inert tubing

____ Fittings for pump

____ 40-ml amber glass vials; Teflon-lined septa

____ Hach field kit for chlorine (optional)

____ Na_2SO_4 crystals, if appropriate

____ Foam sleeves, coolers, and Blue Ice (or equivalent)

____ Stainless steel cable, reel, and tripod (if needed)

____ Air compressor or bottled nitrogen

____ Plastic sheet

____ Daily Activity Log forms or field notebook

____ Chain-of-Custody/Request for Analysis Forms

____ Sample Collection Logs

____ Water Quality Sampling Record form(s)

____ Water Quality Stabilization Record form(s)

____ Variance logs

____ Custody seals

____ Sample labels

____ Any PPE listed or required in the SSHASP

Any additional supplies listed in associated procedures, as needed

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